

CLAIMS

1. A process of preparing a biogenic silica comprising the steps of:
 - a) incinerating a silica bearing organic source at a temperature up to 1200°C and allowing the incinerated silica organic source to cool;
 - b) adding the incinerated and cooled silica bearing organic source to an alkaline solution that has either been preheated to a temperature up to about 65°C or to be heated with the added organic source to a temperature up to about 65°C, the alkaline solution being contained in a vessel and having a pH up to 14;
 - c) applying heat so that the added organic source and the alkaline solution in the vessel are at a temperature between 100°C and up to about 300°C for 1 to 4 hours, thereby forming an aqueous biogenic silica and undissolved impurities derived from the added organic source; and
 - d) extracting the aqueous biogenic silica from the vessel.
2. The process according to claim 1 further comprises the step of:
 - e) solidifying the extracted aqueous biogenic silica to a solid form.
3. The process according to claim 1 or 2 wherein the silica bearing organic source is selected from one or a combination of two or more of group comprising rice hulls, wheat hulls, and herbs with a high level of silica.
4. The process according to claim 3 wherein the herbs include urtica dioca (stinging nettle) and Equisetum (horsetail).
5. The process according to any one of claims 1 to 4 wherein the added silica bearing organic source constitutes 2 to 22 by weight, and the alkaline solution constitute 3 to 8% by weight of an hydroxide or hydroxides and 70 to 95% by weight of water.
6. The process according to claim 5 wherein the hydroxides is selected from hydroxides of sodium, lithium, potassium, rubidium, cesium and francium.
7. The process according to claim 5 or 6 wherein the added silica bearing organic source is in a proportion of about 320g of incinerated rice hulls to the alkaline solution of about 160g of an hydroxide or hydroxides and 3 litre of water.

8. The process according to any one of claims 1 to 7 wherein the vessel is pressurised so that the heat is applied at a relatively high pressure therein.
9. The process according to claim 8 wherein the vessel has an open top which is covered by a lockable lid with a pressure release valve arranged for releasing excessive pressure within the vessel.
10. The process according to any one of claims 1 to 9 wherein the silica bearing organic source is incinerated at a temperature up to 700°C to form a soluble amorphous silica and thereby the extracted aqueous biogenic silica is amorphous.
11. The process according to any one of claims 1 to 9 wherein the silica bearing organic source is incinerated at a temperature between 700°C to 1200°C to form a soluble crystalline silica and thereby the extracted aqueous biogenic silica is crystalline.
12. An aqueous amorphous biogenic silica produced according to the process as claimed in claim 10.
13. A solid amorphous biogenic silica produced according to the process as claimed in claims 10.
14. An aqueous crystalline biogenic silica produced according to the process as claimed in claim 11.
15. A solid crystalline biogenic silica produced according to the process as claimed in claim 11.
16. A method of remediating media containing inorganic and/or organic pollutants comprising contacting the media with a matrix generating agent having an aqueous or solid biogenic silica obtained according to the process as claimed in one of claims 12 to 15, the matrix generating agent being arranged to generate within the media a silicate matrix having a plurality of active reactive sites for bonding to the pollutants.
17. The method according to claim 16 wherein the media is mixed with the matrix generating agent, and heating the resultant mixture at a temperature that is sufficiently high for a sufficient period to produce kerogenic compounds within said mixture.

18. The method according to claim 17 wherein the kerogenic compounds having kerogen-like or kerogenic structures of large organic geo-polymers of no particular order whereby the kerogenic compounds have an irregular structure, and comprise both aliphatic and aromatic constituents and are capable of trapping within them smaller organic and inorganic molecules.
19. The method according to claim 18 wherein the kerogenic compounds are formed by polycondensation reactions occurring at the reactive sites within the matrix, and the kerogens then become chemically bonded to the matrix and are generally insoluble in both water and most organic solvents.
20. The method according to any one of claims 16 to 19 wherein the organic pollutants include P.C.B.s, polycyclic aromatic hydrocarbons, pesticides, herbicides, insecticides, and related compounds, halogenated solvents, furans, volatile hydrocarbons including benzene, toluene, xylene and other common organic contaminants.
21. The method according to any one of claims 16 to 19 wherein the inorganic pollutants including any of heavy metals comprising lead, cadmium, mercury, chromium, vanadium, and the like, and/or any of radioactive elements comprising uranium, strontium, thorium and other actinide, and/or any of substances containing radioactive elements comprising radioactive iodine.
22. The method according to any one of claims 16 to 21 wherein the media including any of soils, sediments, sludges, water, air and other similar materials.
23. A construction material or fabric treated with the biogenic aqueous silica as claimed in claim 12 or 14 for rendering the treated construction material or fabric with a substantially good flame retardation property and/or termite deterrent property.
24. A semi-conductor wafer manufactured with the silica as claimed in any one of claims 12 to 15.
25. A fertiliser for organic plants comprising the silica as claimed in any one of claims 12 to 15.

26. A process of removing a substantial heavy metal and/or reducing a substantial radioactive level from an animal comprising ingesting the silica as claimed in any one of claims 12 to 15.
27. A method of treating clay soil comprising adding to a mass of clay soil an aqueous or solid biogenic silica according to the any one of claims 12 to 15 in a proportion of between 0.2% to 2% weight to weight of the silica to the clay soil.